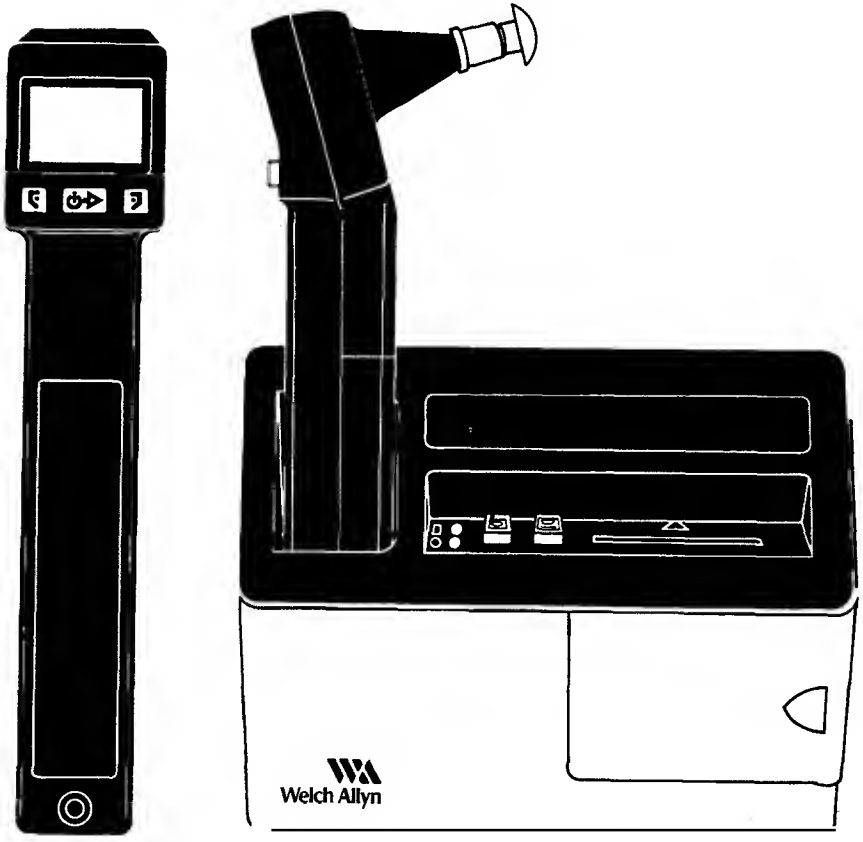
Audio Menu
Service Manual

Welch Allyn

MicroTymp®

and Printer/Charger Operating Instructions



Welch Allyn

Thank you for purchasing the Welch Allyn MicroTymp. The operating and maintenance instructions found in this manual should be followed to ensure many years of accurate and reliable service. Please read these instructions thoroughly before using your new MicroTymp.

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MicroTymp-U.S. Patent Number 4,688,582

Introduction to Tympanometry

Aural acoustic immittance measurements have become an integral component of audiologic and otologic evaluation. One class of aural acoustic immittance measurement, **tympanometty,** has become routine in the assessment of ear disease. Since the original report of Terkildsen and Thomsen (1959) tympanometry has been used widely by physicians and audiologists as a research tool for studying the effects of ear disease on middle ear function and as a clinical test for detecting medically significant pathology. Recent technological advances provide the capability for the MicroTymp, a low-cost, portable, precision instrument that can be of significant value for determining the need for medical referral, for diagnosis of ear disease, and for monitoring the course of medical/surgical intervention.

The Welch Allyn MicroTymp is a single-component aural **acoustic admittance** meter that records a **tympanogram** with a 226-Hz probe tone. In order to properly use the MicroTymp and to interpret the results correctly, the user should be familiar with the basic principles of tympanometry!

Acoustic admittance is the ease with which acoustic energy is transferred from one system to another*. If the air in the ear canal is easily set into vibration, the admittance is high. If the air is difficult to set into vibration the admittance of the system is low. The ease or difficulty of setting the air in the ear canal into vibration is determined by the volume of air and the admittance of the middle ear. Tympanometry provides a method of evaluating the physical characteristics of the middle ear by measuring the admittance of the air trapped in the ear canal.

[1]For more in depth information see:
Margolis, 1981; Margolis and Shanks, 1985; Van Camp et al., 1988.

[2]Mathematically:

$$Ya = \frac{v}{p}$$

where Ya is acoustic admittance, v is volume velocity, and p is sound pressure. The unit of acoustic admittance is the acoustic millimho (mmho).

Tympanometry is the measurement of acoustic admittance as a function of ear canal air pressure. The resulting graph is a tympanogram. Because ear canal air pressure changes the admittance of the middle ear, the admittance of the air in the ear canal changes when the ear is pressurized. Positive or negative pressure, introduced into the sealed ear canal, decreases the admittance of the air in the ear canal by stiffening the eardrum. The effect of air pressure on the acoustic admittance measured in the ear canal is systematically altered by ear disease. Tympanometry is a sensitive indicator of the effects of ear disease on the acoustical/mechanical function of the middle ear.

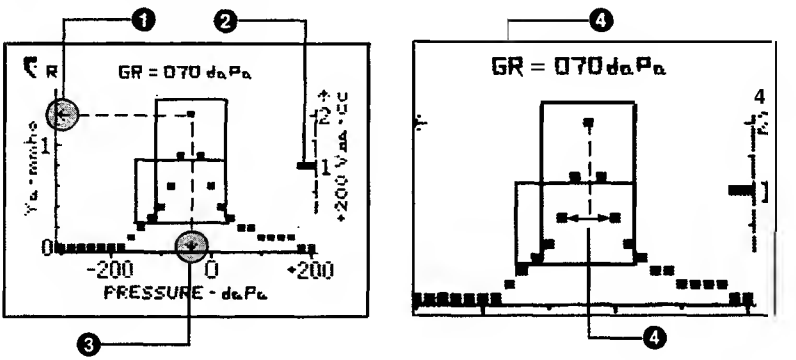
A normal tympanogram is depicted below. Four features of the tympanogram can be used to evaluate the ear under test:

@**Static admittance (Peak Ya)** is a measure of the height of the tympanometric peak. Given appropriate norms, static admittance is a useful indicator of middle ear disease.

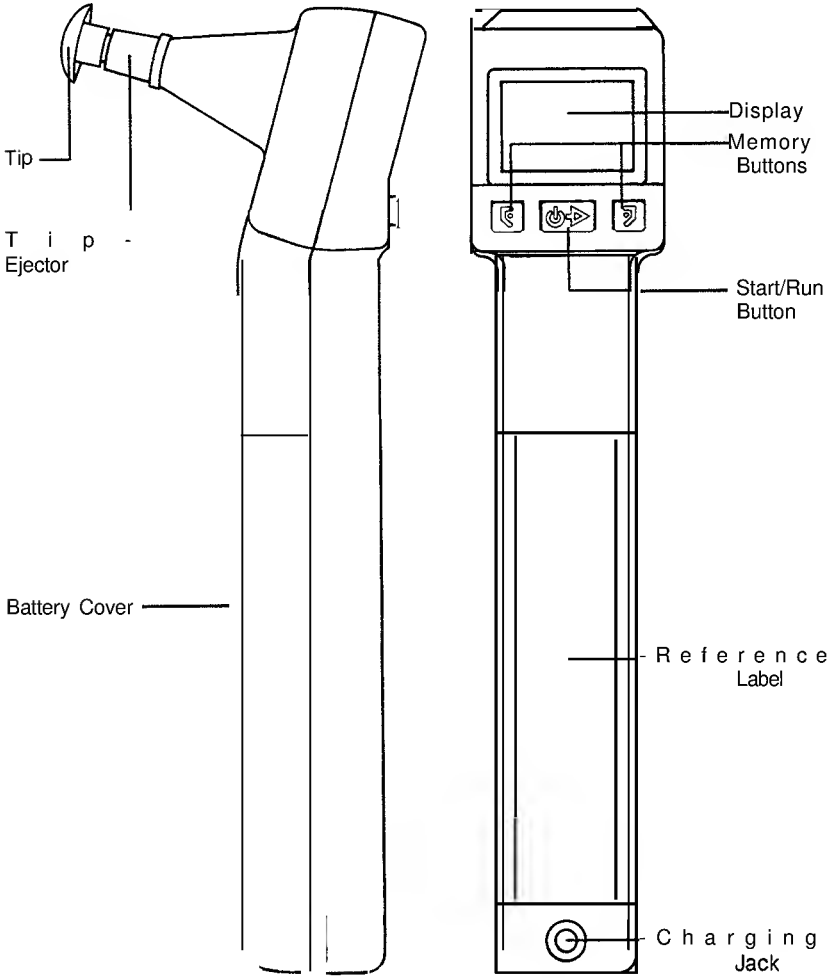
@**Equivalent ear canal volume (+ 200 Vea)*** is the admittance value determined with an ear canal air pressure of + 200 daPa (dekapascals). An abnormally high equivalent ear canal volume suggests the presence of a tympanic membrane perforation, or a patent tympanostomy tube.

❸ **Tympanometric peak pressure (TPP)** is the position of the tympanometric peak on the pressure axis. TPP is an imprecise measure of the middle ear pressure. By itself, TPP is not an accurate indicator of middle ear disease.

❹ **Tympanometric gradient (GR) or tympanometric width** is a measure of the width of the tympanometric peak. Defined as the pressure interval required for a 50% reduction of peak eardrum admittance, tympanometric width is a good indicator of the presence of **middle ear effusion.**



Parts of the MicroTymp

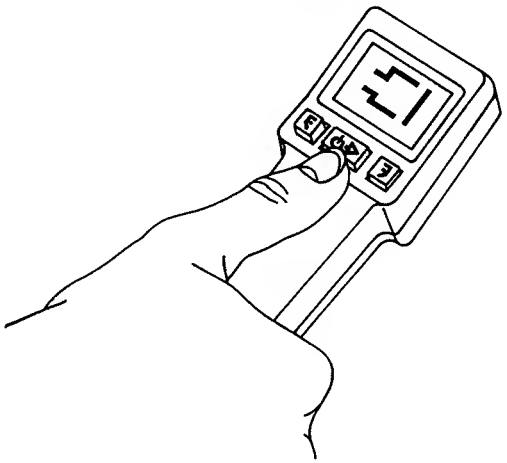


Operating Instructions

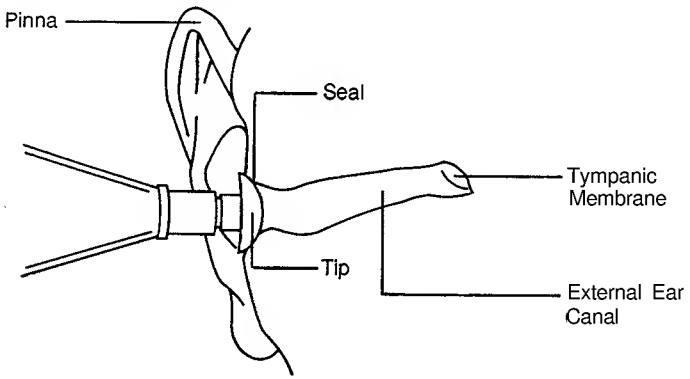
1. If the instrument has not been stored at room temperature, allow 45 minutes for instrument to return to operating temperature range (15-35°C or 59-95°F).

2. To turn instrument ON, momentarily depress START/RUN (⏻▷) button. The OPEN (⊐|) symbol will flash repeatedly in the center of the screen. The RUN (⟹) symbol will flash at the top of the screen.

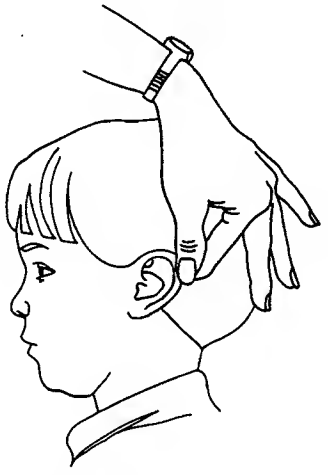
NOTE: The MicroTymp will automatically turn OFF 40 seconds after the last test or activation of any button.



3. Examine the subject's ear canal opening. Select a tip of adequate size to seal the entrance of the ear canal. **Tips are not intended to be inserted within the ear canal.** Improper tip size will cause leaks. Secure tip to instrument.



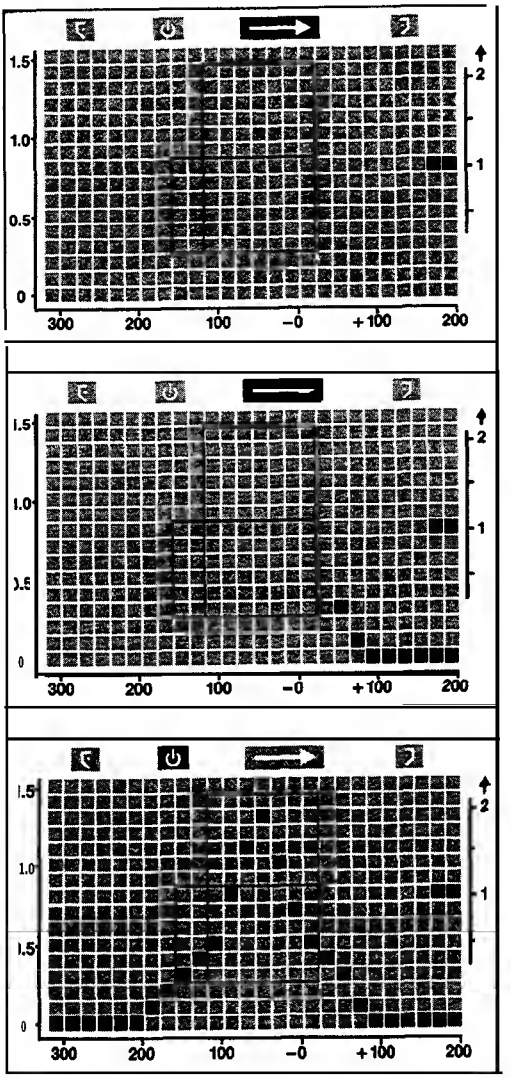
4. Grasp the subject's pinna. Pull gently up and back to straighten the ear canal (or straight back for children).



5. While maintaining tension on the pinna, press the tip firmly against the ear canal opening. **The tip should point straight into the ear canal for adults and slightly anteriorly for children.** Inadequate pressure or misalignment will cause LEAK (=⌐) or BLOCK (⫪) errors which prevent the seal necessary to complete a test.

6. Upon achieving a seal, an indication on the +200 Vea scale will appear. Points will then progress from right to left across the display. If BLOCK (⫪), LEAK (=⌐) or OPEN (⫧) symbols

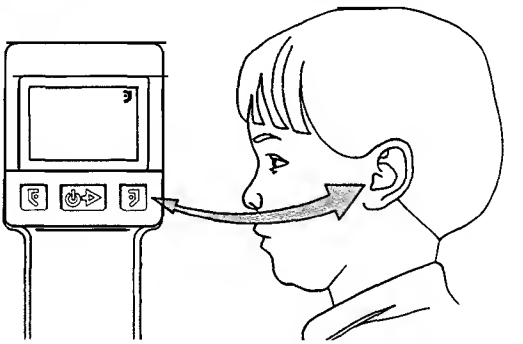
appear, reposition probe to start again. For further explanation, and in case of other symbols, see Display Symbols (pg. 9) for interpretation.



7. Test is complete when RUN (⟹) symbol disappears, and ON/READY (⏻) symbol reappears. Typical test takes approximately 3 seconds.

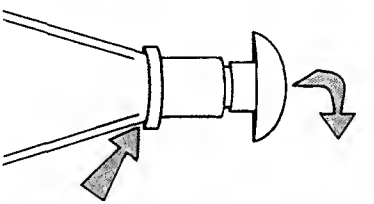
8. To store data for later review or printing:
   1. Makesure unit is ON.
   2. Match pattern on button with observed ear.
   3. Depress appropriate MEMORY (R L) button.
   4. To insure data entry into memory observe memory symbol on screen.

   CAUTION: Holding the MEMORY button down for more than 3 seconds will cause memory to be erased.



9. To **start** new test, depress START/RUN (⏻▷) button.

10. Tips may be removed by hand or by sliding the white tip ejector toward the tip.



11. To **print** results, use Printer/Charger #71130 (pg. 16).

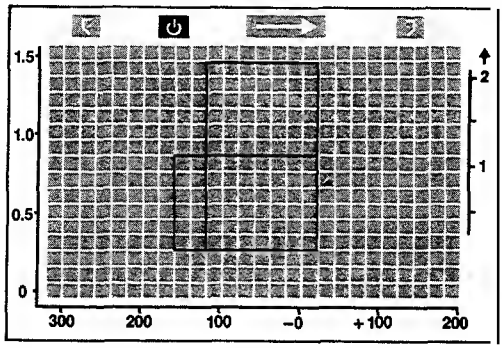
12. To **display** right (R) or left (L) memory contents, press appropriate memory button.

13. To **erase** right (R) or left (L) memory contents, depress appropriate memory button continuously for 3 seconds. BLANK MEMORY (--) symbol will appear.

14. The MicroTymp will turn OFF automatically 40 seconds after the last test or last actuation of any button. Contents of memory are not lost when the unit turns OFF.

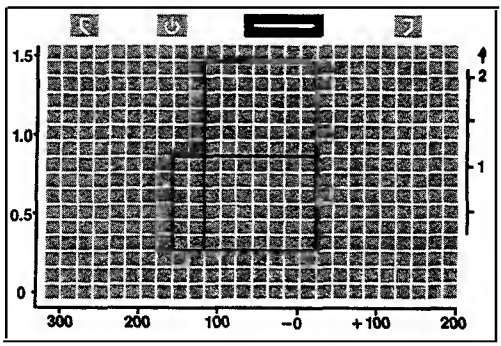
Display Symbols

The information below may be used as a guide to interpret display symbols. Symbol names are used throughout these instructions to describe the graphic display.



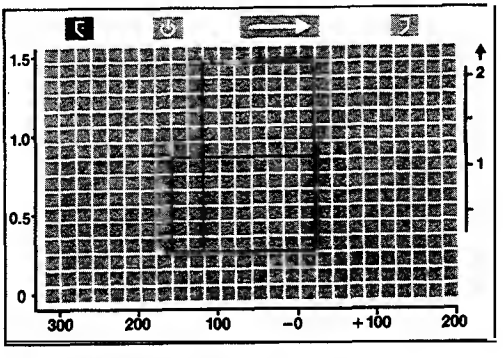
ON/READY

The MicroTymp is on and ready for service.



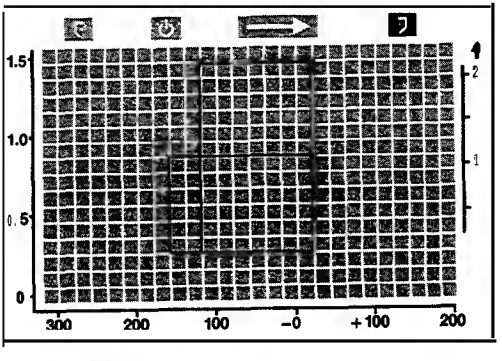
RUN

The test is in progress. When test is complete, this symbol is replaced by ON/READY (⏻▷) symbol. Results may now be stored if desired.



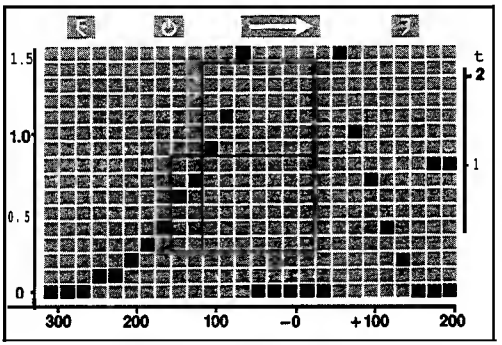
MEMORY #I (Patent's Right Ear)

The contents of Memory #I are being displayed on the screen.



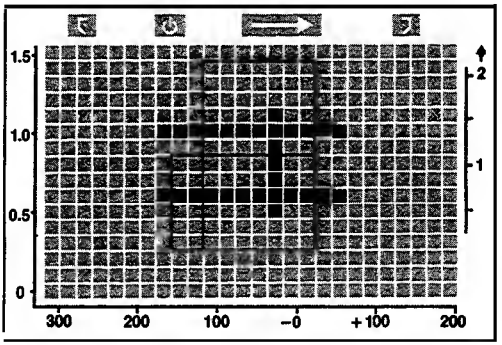
MEMORY #2 (Patient's Left Ear)

The contents of Memory #2 are displayed on the screen.



OVER

The admittance measurement (Peak Ya) has exceeded the scale maximum (1.5 mmho). Points which are over the limit are plotted at 0 mmho.

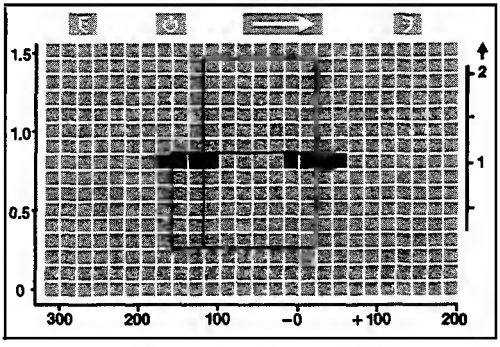


BLOCK

The test cannot progress because the measured admittance is less than 0.2 mmho. This can be caused by:

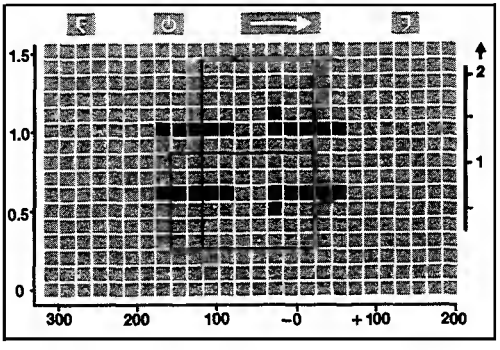
- probe tip lodged against canal wall
- ear canal occlusion
- collapsed ear canal
- extremely small ear

Repositioning probe tip will usually alleviate this condition.



BLANK MEMORY

The memory location indicated does not contain any data.



LEAK

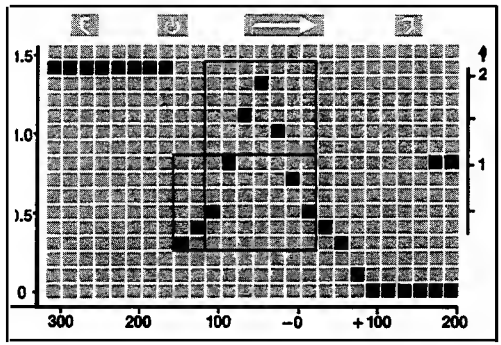
The test cannot proceed because desired pressures within the ear have not been achieved. This occurs when:

- the tip is not completely sealed in the ear canal.
- the tip becomes dislodged during a test.
- the ear canal volume is abnormally large ($>$ 2cc but $\leq$ 2.5cc; above 2.5~~ the OPEN (⊐|) symbol will appear).

To alleviate this condition:

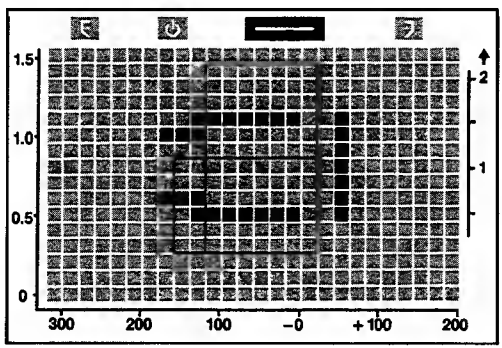
- reposition the tip.
- use a different tip.
- increase pressure against the ear.

NOTE: *If a leak condition occurs after -100 daPa pressure is reached, the pattern will be displayed with a Save the Data Symbol.*



SAVE THE DATA

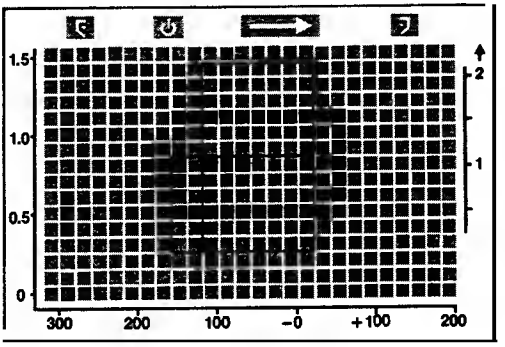
Desired pressures were not reached. This happens when the tip becomes dislodged in the ear canal or if there is a very slight leak throughout the test. Though the test has been interrupted, partial results are displayed. A line at 1.4 mmho has been plotted after the leak condition occurred. Provided that an identifiable peak is present, the test need not be repeated. If no peak can be identified, follow instructions for LEAK (⥤) condition.



OPEN

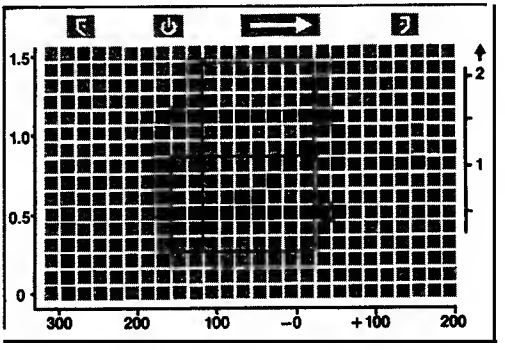
The test has not begun because the total measured admittance (the sum of + 200 Vea and Ya) exceeds 3.5 mmho. This occurs when:

- the unit is not in an ear.
- the probe is not completely sealed in an ear.
- used on perforated or hypermobile tympanic membrane, an ear with patent tympanostomy tubes, or an extremely large canal. Use of a different tip size may alleviate this condition. See Guidelines for Screening (pg. 32) if condition persists.



LOW BATTERY

It is necessary to recharge MicroTymp (pg. 22) as battery voltage has fallen below the level required for testing. The START/RUN (⏻▷) button is inoperative. The MEMORY (ꟻ ꟼ) buttons may be used and data may be printed.

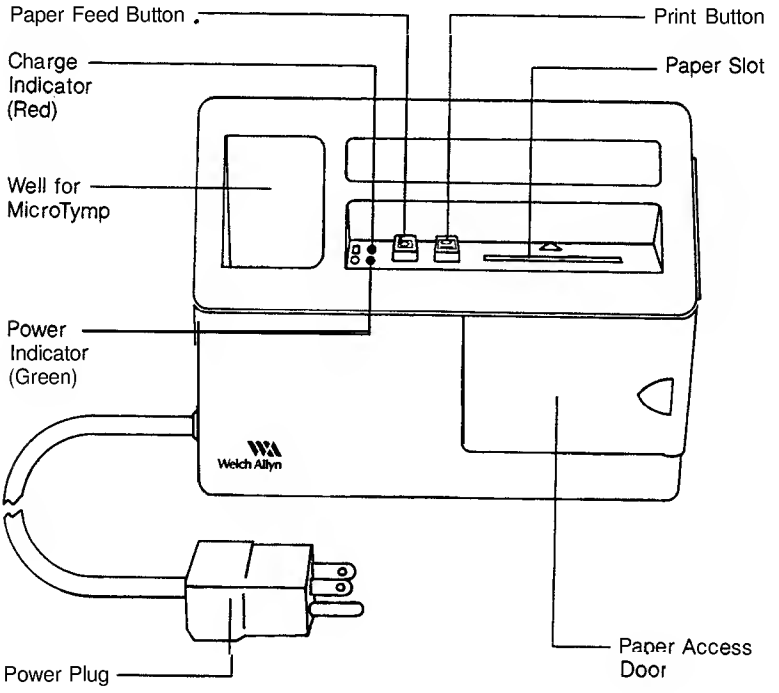


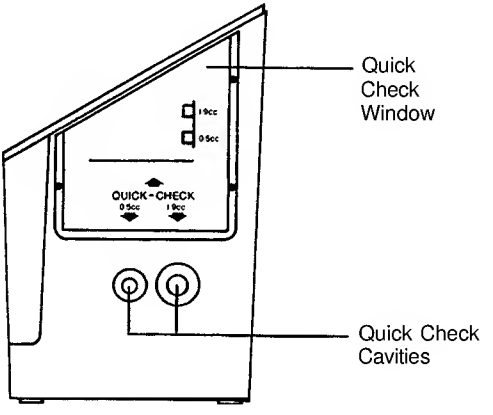
PRESSURE RANGE ERROR

The air pressure in the ear canal when the test began was not correct. The MicroTymp sensed this error. To alleviate this condition, restart MicroTymp. Should this symbol persist, return instrument for servicing (pg. 39).

NOTE: Gradient values are computed by the Printer/Charger and will appear at time of printout.

Parts of the MicroTymp Printer/Charger





Printer/Charger Operating Instructions

WARNING: NOT FOR USE IN THE PRESENCE OF FLAMMABLE ANESTHETICS. POSSIBLE EXPLOSION HAZARD.

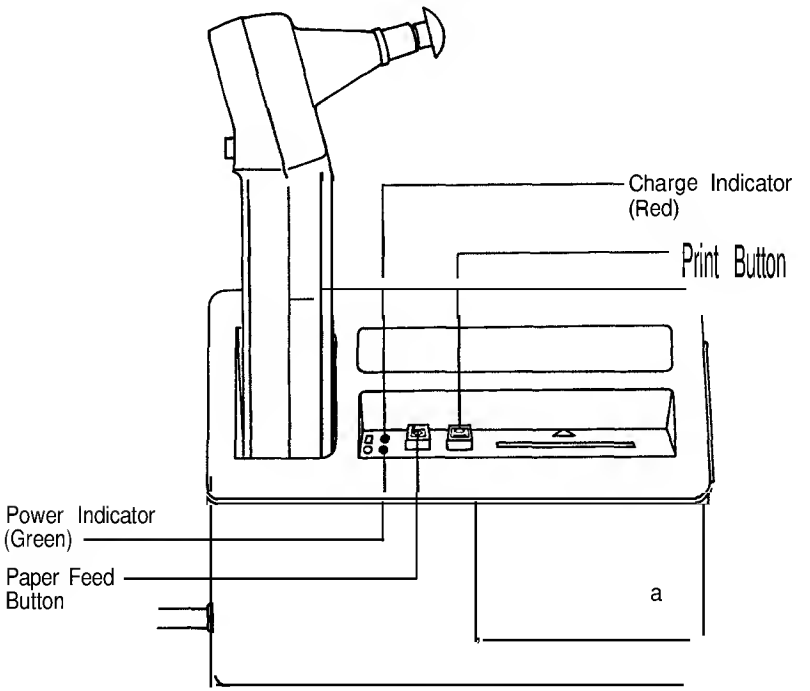
Printing

To print copies of data stored in MicroTymp:

1. Place Printer/Charger on a flat, horizontal surface or mount on a flat;vertical surface (pg. 21).

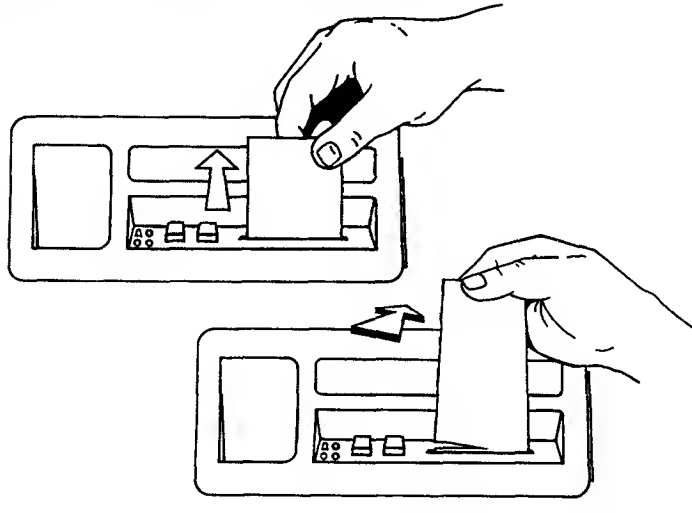
2. Connect the power plug to receptacle of proper voltage, frequency and plug type (pg. 46). The green power indicator will become illuminated.

3. Place MicroTymp in the well with the tip pointing away from the cord. When MicroTymp is properly seated, the red charge indicator will become illuminated. Charge indicator may flicker during printing.



4. Depress and hold PRINT (❑) button momentarily. **Once the printer starts, the handle may be removed from the well.** The red indicator may flicker during printing. A two-ear print-out takes approximately 40 seconds.

CAUTION: Pull paper straight up and to the right toward the back of the unit; pulling too far from side to side or in a downward motion will cause paper to jam.



5. Printed results are an exact copy of information on the MicroTymp display that was stored in memory. If only one memory had data, then only one result will be printed. For a duplicate copy of results, depress PRINT (❑) button again after first printout is complete.

6. **Other Messages:**

No Handle

There was either no MicroTymp in the well or it was not seated properly. Reseat the MicroTymp and ensure that red indicator is illuminated.

No Data

Both memories were empty.

PAPER FEED

To feed extra paper, press FEED ( ) button. Paper will continue to feed as long as the button is depressed.

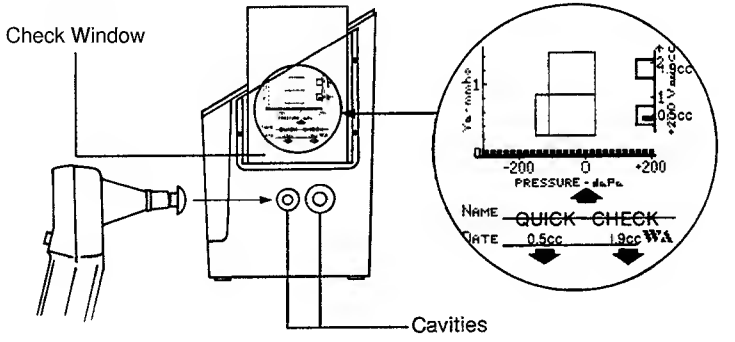
Quick Check

The QUICK CHECK provides a complete functional test of the MicroTymp.

The QUICK CHECK should be used at least once per month and whenever there is any question regarding MicroTymp operation. This provides rapid assurance that the MicroTymp is working properly.

To use the QUICK CHECK:

1. Test .5cc QUICK CHECK cavity as if it were an ear, holding unit carefully to prevent movement. Printer should not be running during the test, and stand should be located on a flat vibration-free surface. Excess noise or vibration during test will cause inaccurate results.
2. Print results for that tracing only (other memory should be empty).
3. Insert results in QUICK CHECK window.
4. Align baseline and +200 Vea axis of the printout with window.
5. The printed value of +200 Vea should fall within the 0.5cc box on the window. If the printout is outside the box, return MicroTymp for recalibration.



6. Repeat steps 1-5 , using the 1.9cc QUICK CHECK cavity and box.

NOTE: While QUICK CHECK provides a functional test, it does not replace recalibration.

As the altitude above sea /eve/ increases, the admittance of an air filled cavity also increases. Therefore, at elevations above 2,600 feet, results using QUICK CHECK will change as follows:

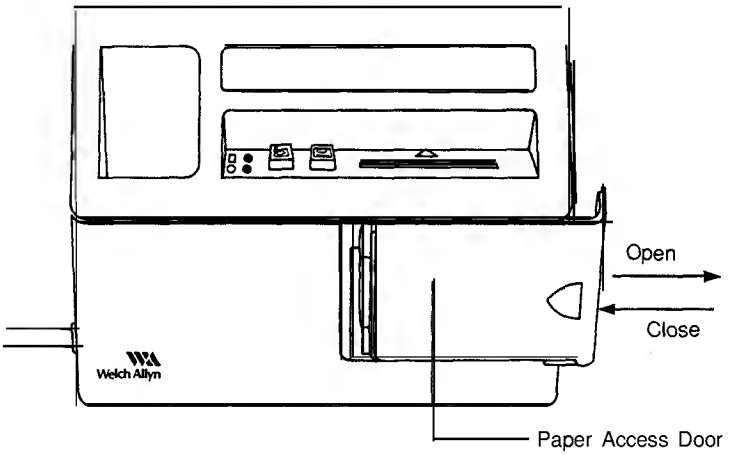
Elevation	**+ 200 Vea Reading Change**	
	.5cc	*1.9cc*
2,600 ft. (792 m)	.occ	+ .2cc
5,000 ft. (1,525 m)	.occ	+ .4cc

Paper Replacement

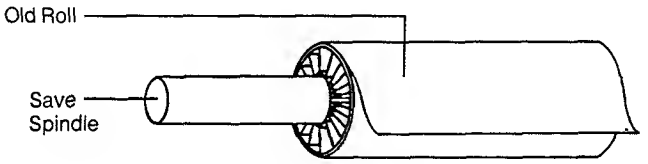
Pink strip indicates need for immediate paper replacement.

CAUTION: Failure to change paper within 4 printouts after the pink strip appears could result in damage to print mechanism.

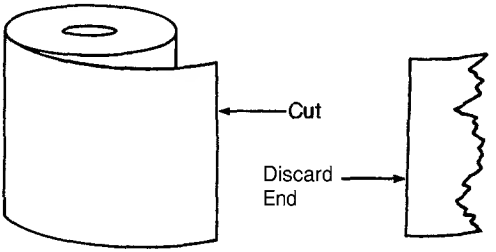
1. Remove paper access door by sliding it to the right.



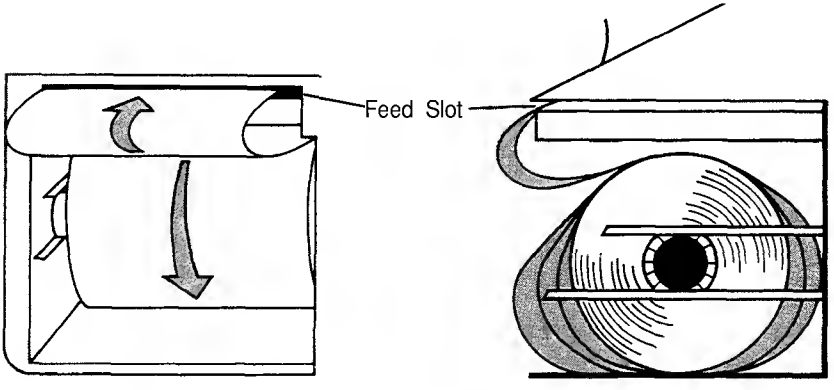
2. Remove and discard old roll of paper, but save black plastic spindle.



3. **Cut end of new roll squarely** and insert black plastic spindle. Torn edge will prevent paper from feeding properly and could cause paper jam.



4. Slide this assembly into grooves into Printer/Charger, making sure to insert paper into feed slot as shown. Push paper while depressing feed button. The paper will be pulled in by the printer. Continue depressing feed button until paper exits top of stand.



Front View

Side View-indicating possible loose areas.

5. Slide paper access door to the left until it snaps closed.

CAUTION: Ensure paper is taut before closing paper access door. Loose paper can cause printer malfunction.

NOTE: Use only Welch Allyn paper (#53600) or Printer/Charger life will be lessened and warrranty voided.

DISASSEMBLY OF PRINTER/CHARGER PRESENTS POSSIBLE ELECTRICAL SHOCK HAZARD.

REFER ALL SERVICING TO QUALIFIED PERSONNEL TO PREVENT POSSIBLE FIRE HAZARD.

Wall Mounting Instructions

1. Choose a location for Printer/Charger within five feet (1.5m) of an electrical outlet.

2. Position mounting bracket vertically on wall and use as template to pencil markings for drill holes.

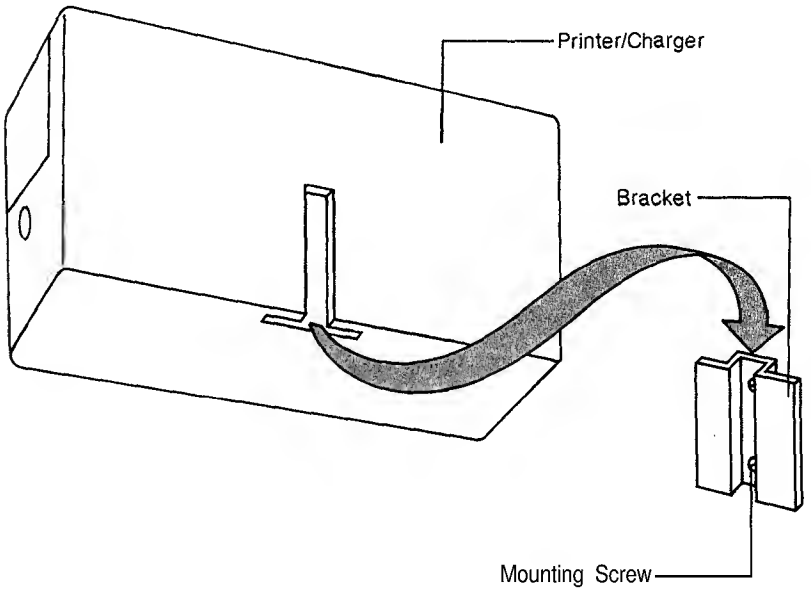
3. Select correct mounting hardware from two provided:

   Sheet metal screws and plastic anchors-for concrete block or plasterboard, use 0.187 in. (4.75mm) diameter drill. Secure anchors to wall.

   Sheet metal screws only-for metal panel or wood walls, use 0.120 in. (3.05mm) diameter drill.

4. Fasten mounting bracket to wall with screws.

5. Mount unit by aligning Printer/Charger cut-out with top of bracket. Push down until seated securely on bracket.



Recharging

The 7.2V nickel-cadmium battery used in the MicroTymp will provide approximately 60 minutes of continuous operation. When the battery is low, the LOW BATTERY (⊡) symbol will appear on the display.

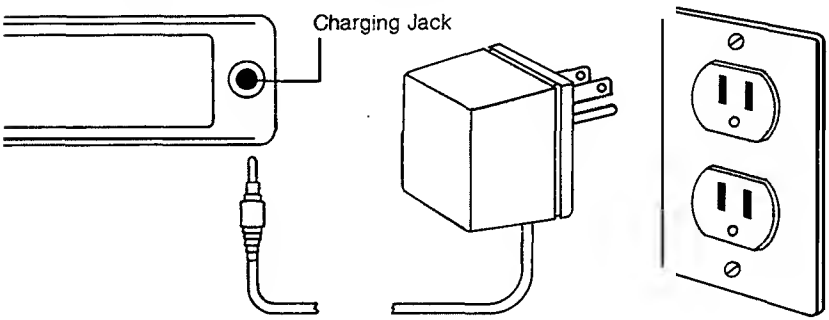
The START/RUN (⏻▷) button is automatically disabled under these conditions to prevent inaccurate results due to inadequate battery voltage. Results may be stored, recalled or printed when the battery is low. The MicroTymp may be recharged by any of these three methods:

1. CHARGING TRANSFORMER

Any of the Welch Allyn's charging transformers (pg. 36) may be used. To recharge:

1. Plug the transformer into a receptacle of appropriate voltage, frequency and plug configuration.

2. Place MicroTvmp on its side and plug the output cord of the transformer into' the charging jack.



(71040 Charging Transformer shown)

2. MODEL 71123 AUDIOSCOPE CHARGING STAND

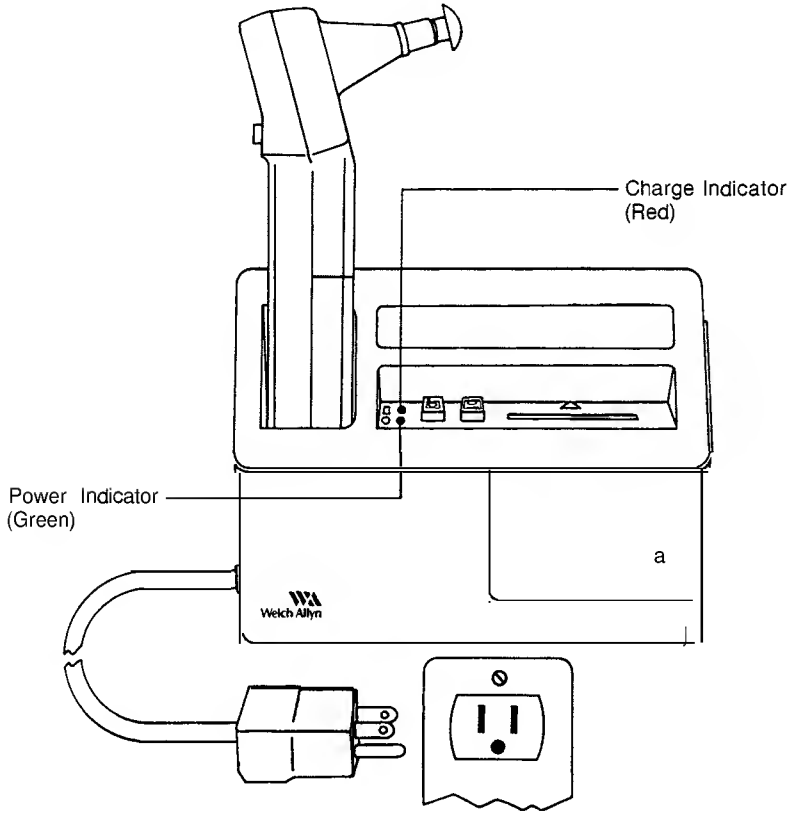
Follow directions included with stand.

3. **MODEL 71130 PRINTER/CHARGER**

1. Place Printer/Charger on a flat horizontal surface or mount it on a flat, vertical surface (pg. 21).

2. Connect the power plug to a receptacle of proper voltage, frequency and plug type (pg. 46). The green power indicator will become illuminated.

3. Place MicroTymp into the charging well. **MicroTymp will fit into the well only one way.** When properly seated the red charge indicator will become illuminated.



A fully drained battery may be recharged overnight by any of the preceding methods (71040 Charging Transformer, 71130 Printer/ Charger or 71123 Charging Stand). The MicroTymp may be charged indefinitely without damage to the battery.

Special Notes:

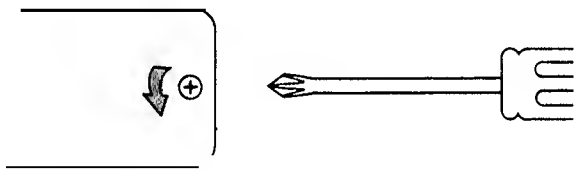
- Slight heating of MicroTymp handle is normal
- Batteries will not leak
- Batteries will discharge gradually over a period of about 60 days when stored at room temperature (70°F). Storage at higher temperatures will accelerate discharge rate.

Battery Replacement

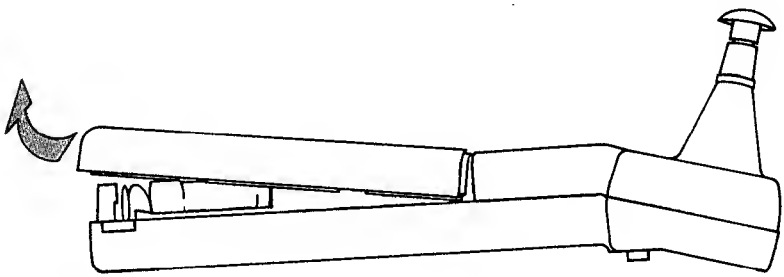
The MicroTymp battery is intended for many charge/discharge cycles and is warranted for two years (expiration date is imprinted on battery). REMOVAL OF BATTERY WILL RESULT IN LOSS OF MEMORY CONTENTS. To replace:

1. Allow MicroTymp to turn OFF.

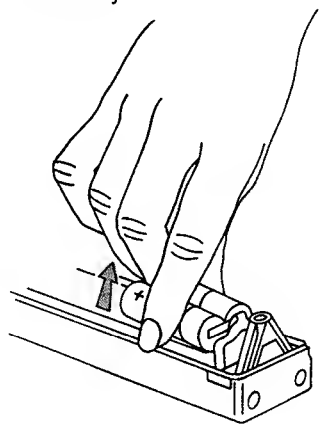
2. Unscrew battery cover using a small Phillips head screwdriver. Save this screw.



3. Remove battery cover by lifting up and away from the tip end of MicroTymp.



4. Grasp and pull up on battery.

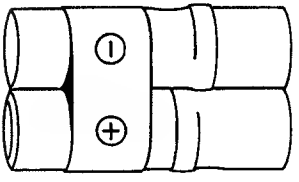


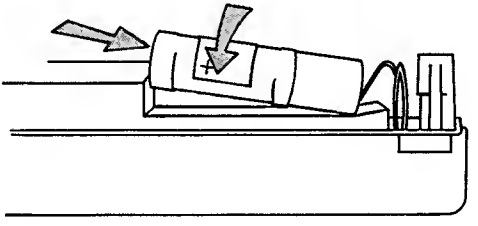
5. Making sure that POLARITY marking on battery corresponds to the marking on the instrument, insert new battery:

WARNING: insert battery only as shown. Failure to observe correct polarity could cause damage to instrument.

1. First lower unmarked end of battery into holder against spring.

2. Push battery lightly to compress spring, and lower battery into compartment.



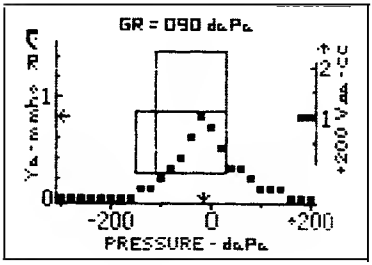


6. To replace cover, first insert tip end under front cover, then lower opposite end and replace screw. To avoid stripping screw threads, do not tighten excessively.

REPLACE WITH WELCH ALLYN NO. 72700 BATTERY ONLY. RISK OF FIRE MAY OTHERWISE OCCUR.

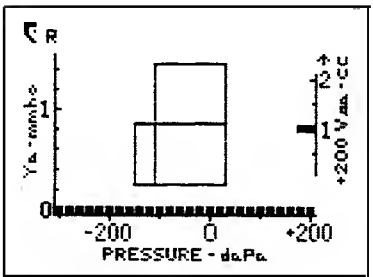
CAUTION: The battery must be removed if the MicroTymp is going to be stored or placed anywhere other than in the Charging Stand (or Charging Transformer) for more than one month. Failure to do this can result in damage to the battery and the MicroTymp.

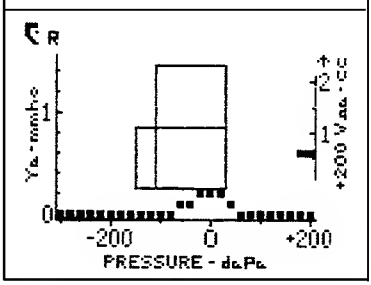
Interpretation of Results



Normal Tympanogram

Indicates normally functioning middle ear system



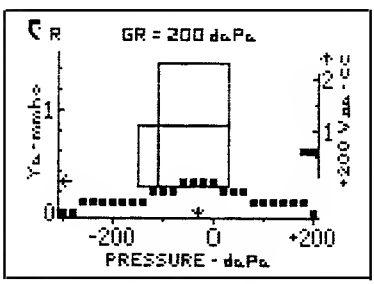


Low Static Admittance

Low Static Admittance (low peak height) indicates possibility of:

- Otitis media with effusion
- Cholesteotoma/other middle ear tumor
- Tympanosclerosis
- Otosclerosis

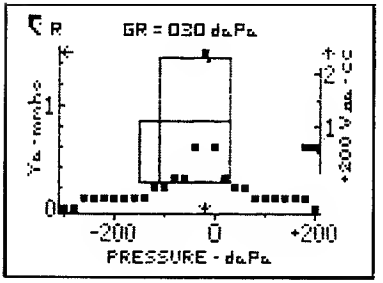
NOTE: When peak admittance is below the box, no gradient value will be printed.



Gradient Too Wide

Gradient Too Wide (GR > 151 daPa in children or >114 daPa in adults) indicates possibility of:

- Otitis media with effusion

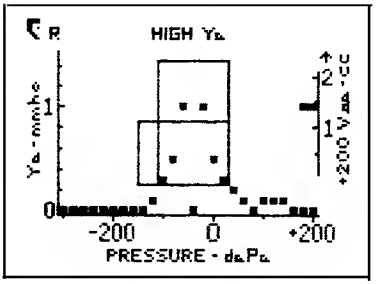


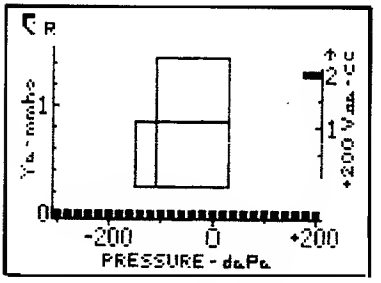
High Static Admittance

High Static Admittance (high peak height) indicates possibility of:

- Tympanic membrane abnormalities
- Ossicular disruption

NOTE: "HIGH Ya" will print out in place of gradient (GR) value when admittance exceeds 1.5 mmho (see OVER, pg. 11).



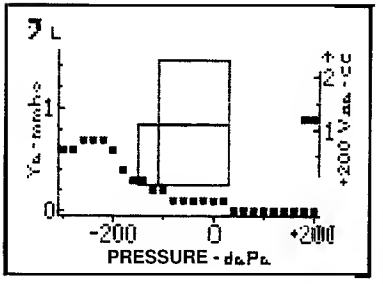


Volume (+ 200 Vea) Too Large

Excessively large volume in presence of flat tympanogram indicates possibility of:

- Perforated tympanic membrane
- Patent tympanostomy tube

NOTE: If volume exceeds 2cc, a LEAK (= ⊨) symbol will appear; above 2.5cc, an OPEN (⊐|) symbol will appear.



Negative Tympanometric Peak Pressure

Negative TPP indicates eustachian tube dysfunction as a result of:

- Oncoming/Resolving Otitis Media
- Cold
- Coughing
- Allergy
- Sniffing

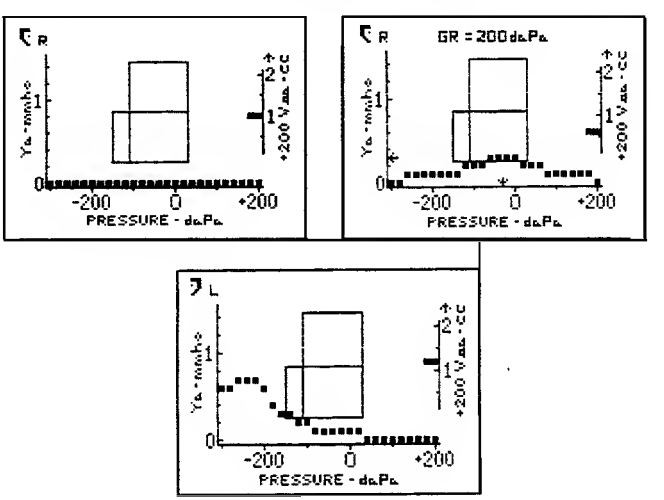
Abnormal tympanograms can be grouped into two broad categories: low-admittance pathologies and high-admittance pathologies. Low-admittance pathologies include space-occupying lesions of the middle ear (e.g. **otitis media with effusion,** middle ear tumors), ossicular fixation (e.g. **otosclerosis, lateral ossicular fixation),** and conditions that artificially flatten the tympanogram (e.g. ear canal occlusion, tympanic membrane perforation). High-admittance pathologies include eardrum abnormalities and ossicular disruptions. Typical results from each of these conditions are presented below.

LOW-ADMITTANCE PATHOLOGIES

Space-occupying *lesions* of the middle ear.

These conditions produce low static admittance of the middle ear by a variety of mechanisms. A lesion that displaces air in the middle ear space will cause low admittance by reducing the middle ear volume. The lesion may also interfere with the vibration of the ossicular chain, contributing to the low admittance. Finally, if the lesion is in contact with the eardrum, low admittance will result from interference with eardrum vibration.

1. **Otitis media with effusion (OME):** Tympanometric characteristics of patients with OME typically include one or more of the following: low static admittance, wide tympanometric gradient (width), and negative tympanometric peak pressure. In advanced cases, OME results in flat tympanograms (low static admittance). In intermediate stages of OME, the peak height may be normal, but the gradient too wide and/or the peak too negative.

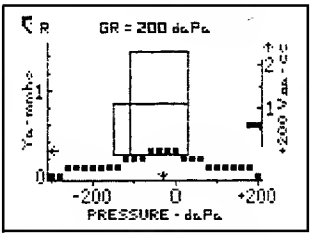


2. **Middle ear tumor:** There is a wide variety of neoplastic processes that invade the middle ear. The most common is the **keratoma (cholesteatoma),** a collection of keratinizing squamous epithelium that frequently originates from Shrapnell's membrane (pars flaccida) of the tympanic membrane or the ear canal wall, and invades the middle ear space. Other middle ear tumors include the cholesterol granuloma, glomus tumor, and squamous cell carcinoma (cf. Goodhill, 1979). These generally result in a flat tympanogram.

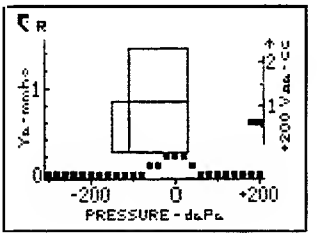
Ossicular fixation.

Ossicular fixation may result from **tympanosclerosis,** a complication of chronic otitis media that may involve the eardrum, malleus, incus, and/or stapes, or from otosclerosis, a genetic condition of delayed onset that produces a focal lesion, immobilizing the stapes footplate. In general, the more lateral the fixation, the more effect the condition has on the tympanogram.

1. **Lateral ossicular fixation:** Tympanograms recorded from patients with lateral ossicular fixation are typically characterized by low admittance and a wide tympanometric gradient (width).



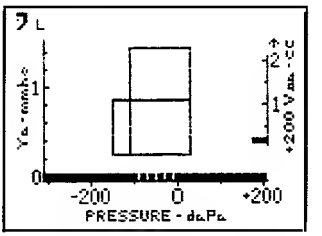
2. **Otosclerosis:** Because the otosclerotic lesion is more medial than lateral ossicular fixation, the tympanogram is less affected. The tympanometric shape is often indistinguishable from normal, although the static admittance may be slightly low and the tympanometric gradient (width) may be narrower than the normal tympanogram.



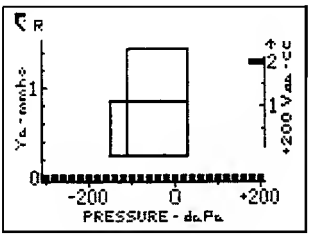
Conditions *that* artificial/y flatten the tympanogram.

In order to measure the mechanical properties of the middle ear, the MicroTymp must be capable of changing the pressure differential across the eardrum. Two conditions can prevent this from happening and artificially flatten the tympanogram:

1. **Ear canal occlusion:** If the ear canal is occluded by impacted cerumen, foreign body, tumor, stenosis, or atresia, the volume of air in front of the probe will be very small. This small volume may be manifest in two ways with the Welch Allyn MicroTymp:
   - The BLOCK (=) symbol may be displayed, indicating that the equivalent volume in front of the probe is less than 0.2 cc
   - A flat tympanogram may occur with a small equivalent volume (< .4cc for children or < .6cc for adults)



2. **Tympanic membrane perforation or patent tympanostomy tube:** In these cases the air pressure produced by the MicroTymp escapes through the perforation or tube so that a pressure difference across the eardrum does not occur. Because the air pressure changes have no effect on the tension of the eardrum, the tympanogram is flat. In cases in which the middle ear mucosa is relatively normal, the flat tympanogram will be accompanied by a large equivalent volume (> 1.5 cc for adults and 1.0 cc for preschool-aged children). Many patients with tympanic membrane perforations have a flat tympanogram but do not show a large equivalent volume due to inflammation of the middle ear.



Note: If volume exceeds 2.0 cc the MicroTymp will not record a tympanogram. Above 2.0 cc a LEAK (⊨) symbol will appear; above 2.5 cc, an OPEN (⊏|) symbol will appear.

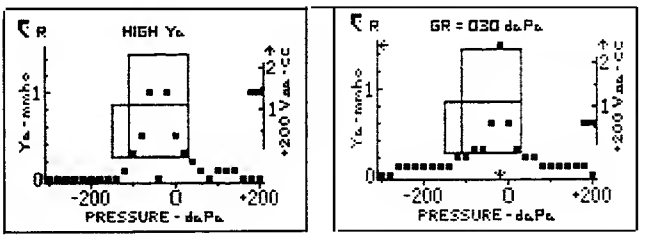
HIGH ADMITTANCE PATHOLOGIES

Tympanic membrane abnormalities.

The tympanic membrane is normally a stiff, conically-shaped structure that derives its stiff characteristic from the lamina propria, a layer of connective tissue that is situated between the outer layer of squamous epithelium (skin) and the inner layer of mucous membrane. When the eardrum heals after a relatively large perforation, the lamina propria may be absent or thin in the region of the scar. This **neomembrane** can be set into vibration with greater ease than the normally-stiff tympanic membrane. The result is a high static admittance. Although the tympanogram is abnormal, the condition rarely affects hearing sensitivity or requires further medical treatment.

Ossicular disruption.

Disruption of the ossicular chain ranges from partial interruption with fibrous attachments between ossicular remnants, to complete absence of the ossicles. These conditions result from the erosive effects of chronic infection, trauma, and congenital defect. Ossicular disruption is usually associated with a substantial conductive hearing loss. Because the ossicles normally "load" the eardrum, contributing to its tension, the eardrum in an ear with ossicular disruption can be more easily set into vibration than the normal eardrum. This results in high static admittance.



Guidelines for Screening

(For Hearing Impairment and Middle Ear Disorders)

introduction

In a non-medical setting, tympanometry can be useful in determining the need for a medical referral. However, abnormal tympanometric results occur not only in patients that have ear disease that requires medical attention, but also in subjects with transient conditions that resolve without medical intervention and in ears that have residual effects of previously-controlled disease. Consequently, it is unwise to base the decision of a medical referral on tympanometric results alone. Screening protocols that have done so resulted in an excessively high over-referral rate (see Margolis and Heller, 1987, for a discussion).

A recommended screening protocol (Margolis and Heller, 1987) for determining the need for medical referral is illustrated on page 34. The protocol relies on information derived from history, visual inspection of the ear, audiometric screening, and tympanometry. The use of each type of screening data is discussed below.

Note on Tympanometry

Because abnormal tympanograms occur in transient middle ear conditions that do not require medical attention, the occurrence of tympanometric abnormalities must be interpreted with caution. Some tympanometric abnormalities are cause for an immediate medical referral, while others warrant a referral only if they persist over an extended period of time.

❶ Recent Ear Pain/Discharge

Ideally, the decision for or against medical referral would incorporate a consideration of the complete case history. However, it is often not feasible to obtain a thorough history in a screening protocol. Any recent history of otalgia (ear pain) or otorrhea (discharge from the ear), however, is cause for immediate medical referral. Further testing is not necessary.

❷ Visual Inspection of the Ear

Although the clinician administering the screening may not be a skilled otoscopist, the protocol should include an inspection of the ear. Sometimes visual evidence of ear disease can be obtained without an otoscope, e.g. otorrhea and developmental defects. In other cases, otoscopic inspection may reveal abnormalities that usually can be detected by the clinician with a moderate amount of experience. The following conditions should result in immediate medical referral:

- structural defect
- blood, effusion, foreign body, occlusion, inflammation, or growth in the ear canal
- distorted or absent tympanic membrane landmarks

❸❹ Audiometric Screening

Audiometric testing is not very sensitive to many pathological conditions of the middle ear. Nevertheless, inclusion of audiometric screening in the screening protocol can be helpful in detecting middle ear disease. In addition, the inclusion of audiometry in the screening protocol allows for the detection of sensorineural hearing loss.

The audiometric screen typically consists of the presentation of tonal stimuli with frequencies of 1000, 2000, and 4000 Hz at 20 dB Hearing Level. Frequently a fourth frequency, 500 Hz, is included. If the patient fails to respond to one or more stimuli, the audiometric screen should be repeated, either on site or at a later date. Alternatively, a more thorough audiometric evaluation could be conducted.

❺❼ Peak (Ya) Too Low

When static admittance (Peak Ya) is abnormally low (see normal boxes on MicroTymp) a retest using the entire protocol should be administered after 4-6 weeks. Only upon two consecutive occurrences of low static admittance should a medical referral be recommended, provided that the abnormal result is not accompanied by other abnormalities.

NOTE: When the peak is too high in the presence of normal hearing, no medical referral is necessary,

❻ Volume (+ 200 Vea) Too Large

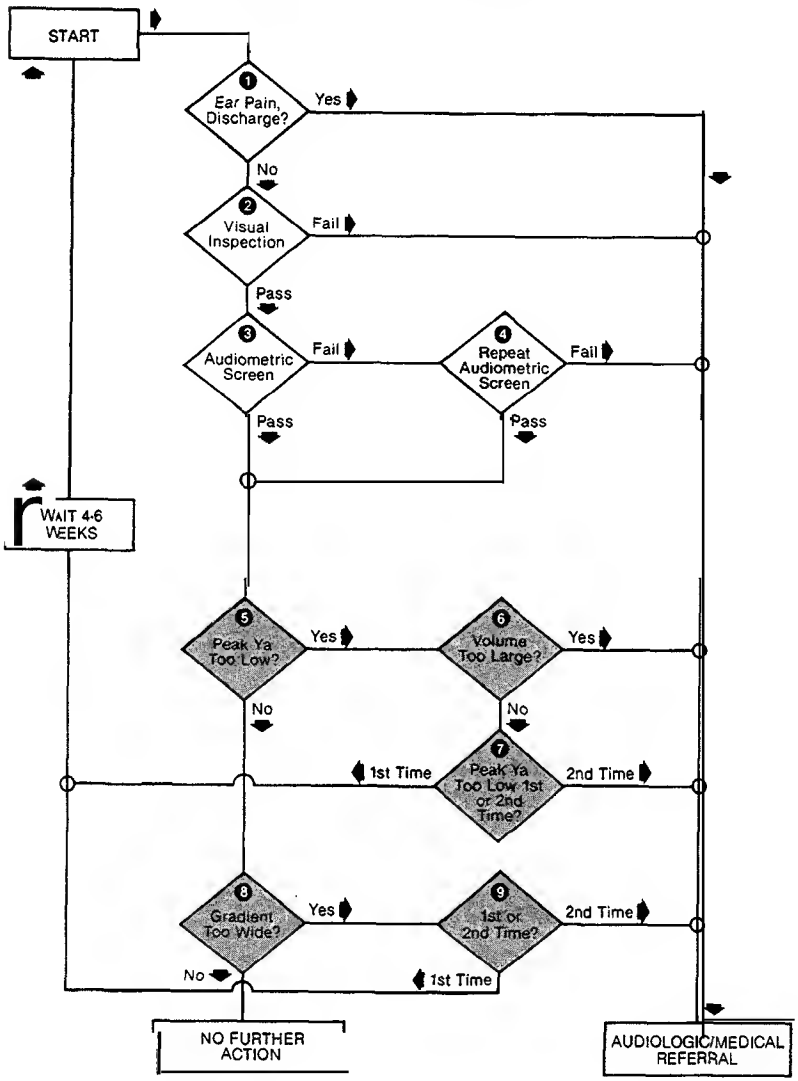
The presence of a flat tympanogram accompanied by a large ear canal volume (>1.5 cc in adults or >1.0 cc in preschool aged children) is evidence of a tympanic membrane perforation and warrants an immediate referral.

❽❾ Gradient (Width) Too Wide

When tympanometric gradient is abnormal, (> 114 daPa for adults and > 151 daPa for preschool aged children), a retest using the entire protocol should be administered after 4-6 weeks. Only upon two consecutive occurrences of abnormal results should a medical referral be recommended, provided that the abnormal result is not accompanied by other abnormalities.

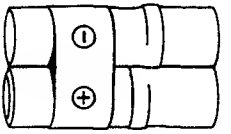
NOTE: Abnormal tympanometric peak pressure is not recommended as a referral criterion because it is not consistently associated with middle ear disease of medical significance.

Guidelines for Screening for Hearing Impairment and Middle Ear Disorders*



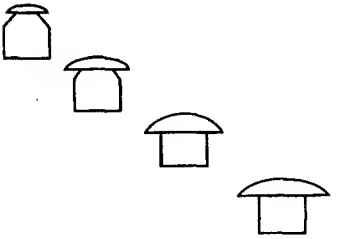
*Proposed New American Speech Hearing Association (ASHA) Guideline.

Replacement Parts



No. 72700 7.2V Nickel Cadmium Battery

No. 23630 Set of 4 Tips

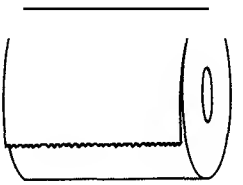


No. 23621 Small Tip (White)

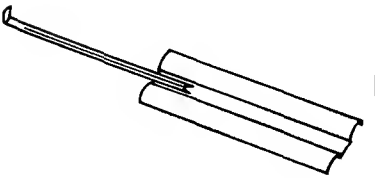
No. 23622 Medium Tip (Black)

No. 23623 Large Tip (Gray)

No. 23624 Extra Large Tip (Blue)



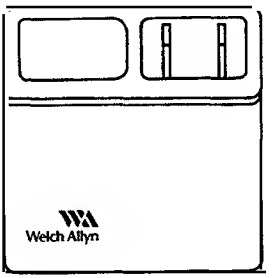
No. 53600 Roll of Paper



No. 236186 Cleaning Tool

No. 711524 Spindle for Paper

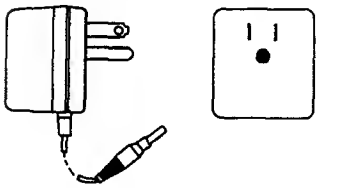
No. 236081 Screw for Battery Cover



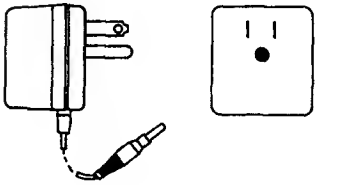
No. 71123 AudioScope Charging Stand (Also charges MicroTymp; does not have printer).

Charging Transformers

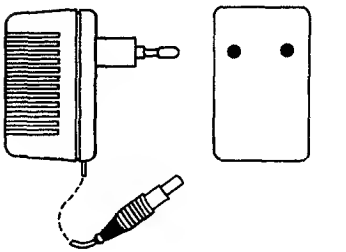
Any of the following Welch Allyn Charging Transformers may be used with this instrument:



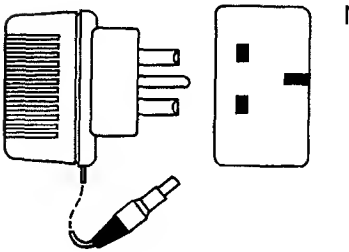
No. 71040 110-130v input
UL Listed, CSA Certified



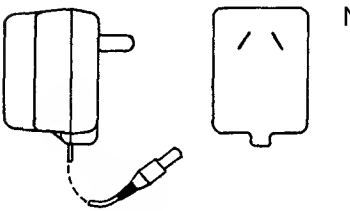
No. 71030 90-110v Input



No. 71032 220-240v Input Compliant with IEC 601-I



No. 71034 230-250v Input Compliant with IEC 601-I



No. 71036 230-250v Input
SAA Approved

All transformers operate at either 50 or 60 Hz.

Cleaning and Sterilization

MicroTymp

Do not sterilize. May be cleaned by wiping with a dry cloth or a cloth that has been lightly dampened with 70% Isopropyl Alcohol. Care should be taken to prevent seepage of liquid into instrument, especially in the tip area. The probe tip opening and three inside ports should be inspected for debris monthly. Any dust, cerumen or other material in this area may effect the accuracy and/or functioning of the instrument.

Cleaning Tool

A cleaning tool (#236186) has been provided with your Welch Allyn MicroTymp and is attached to this page.

Clean the MicroTymp probe once each month or when debris is visible.

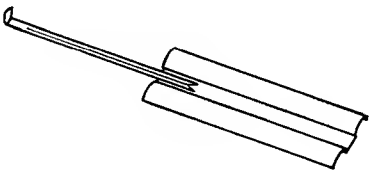
1. Remove tip
2. Insert hooked end of cleaning tool and scoop out cerumen and other debris, taking care not to push material into probe.

Printer/Charger

Do not sterilize. May be cleaned by wiping with a dry cloth. Care should be taken to ensure that no material enters the Quick Check orifices.

Charging Transformers

None of the charging transformers should be sterilized. All may be cleaned by wiping with a dry cloth.



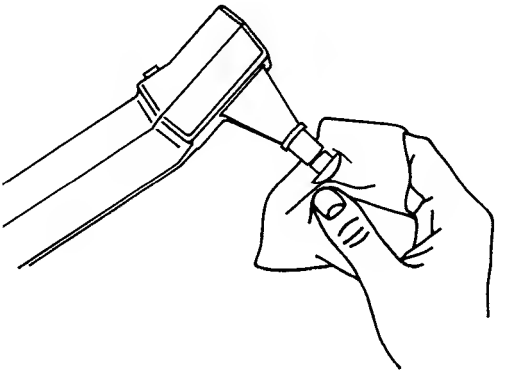
Tips

Will withstand cleaning or sterilization by any one of the following:

Ethylene Oxide (130°F, 8 PSI. 4 hr. cycle)
Steam Autoclave (270°F, 27 PSI. 6 min. cycle)
Cidex
Cidex 7
70% Isopropyl Alcohol
Betadine (10% by volume)
Wescodyne (10% by volume)
Boiling water (30 min.)

NOTE: Zepharin Chloride (with or without anti-rust tablets) is not recommended. The use of Betadine, Wescodyne or boiling water may discolor tips; however, performance is not affected.

CAUTION: If the tips are wiped while attached to the instrument, the probe tip should be pointed down to prevent seepage of liquid into probe tip.



Repair

Repair must be done by authorized personnel. Failure to do so will invalidate warranty. Return to:

REPAIR DEPARTMENT
WELCH ALLYN, INC.
STATE STREET ROAD
SKANEATELES FALLS, NY 13X3-0220
U.S.A.

Outside of the United States, return MicroTymp to your local authorized Welch Allyn Distributor.

Recalibration

Annual calibration checks are recommended for the MicroTymp. Arrangements for recalibration may be made by returning the instrument registration card, or by contacting Welch Allyn or an authorized Welch Allyn MicroTymp distributor. The MicroTymp warranty may be extended for up to three years provided the instrument is returned each year for recalibration. A monthly functional check using the Quick Check is also recommended. No recalibration is required for the Printer/Charger. There is a moderate fee for recalibration.

Glossary

acoustic admittance (Ya)—the ease with which acoustic energy is transferred into a system; the ratio of volume velocity to sound pressure.

acoustic millimho (mmho)—the unit of acoustic admittance; 1 mmho = 10^{-8} m^3/pa s.

aural acoustic immittance-a term used to refer to aural acoustic admittance, acoustic impedance, or any of their components.

cholesteatoma-see keratoma.

dekapascal (daPa)—the unit of air pressure used for tympanometric measurements. 1 daPa = 1.04 mm H20.

equivalent ear canal volume (+ 200 Vea)—the volume of air that has the same acoustic admittance as the ear canal/middle ear system when the ear is pressurized. The MicroTymp measures Vea with a 226-Hz probe tone and an ear canal air pressure of t-200 daPa. Under these conditions, Vea is a good estimate of the volume of air in front of the probe. Vea is abnormally large in some patients with ear drum perforations and patent tympanostomy tubes.

keratoma-a collection of keratinizing squamous epithelium that invades the middle ear; it frequently originates from a perforation in Shrapnell's membrane (pars flaccida) of the tympanic membrane; also called cholesteatoma.

lateral ossicular fixation-fixation of the malleus and/or incus, frequently caused by tympanosclerosis, a complication of chronic otitis media.

middle ear effusion-an accumulation of fluid (liquid) in the middle ear.

neomembrane-a scar on the tympanic membrane; the scarred region may be thinner and have a higher admittance than the normal tympanic membrane.

otitis media with effusion-inflammation of the middle ear accompanied by an accumulation of fluid (liquid).

otosclerosis-a genetic abnormality of the temporal bone, frequently causing fixation of the stapes and conductive hearing loss.

sound pressure-the average (rms) difference between the air pressure that occurs during sound transmission and the ambient air pressure.

static admittance-the admittance of the middle ear at the air pressure corresponding to the tympanometric peak. It is calculated by subtracting the admittance of the ear canal from the admittance at the tympanometric peak. The MicroTymp estimates static admittance by subtracting the admittance at 200 daPa from the peak admittance.

tympanogram-a recording of the admittance of the ear as a function of ear canal air pressure.

tympanometric gradient-a measure of the shape of thtympanogram in the region of the tympanometric peak. The MicroTymp calculates the gradient by determining the pressure interval corresponding to a 50% reduction in admittance on either side of the peak. Also called the tympanometric width.

tympanometric peak pressure-the value of ear canal air pressure at which the tympanometric peak occurs.

tympanometric width-see tympanometric gradient.

tympanometry-the measurement of acoustic admittance in the sealed ear canal as a function of ear canal air pressure.

tympanosclerosis-a complication of otitis media that is characterized by sclerotic regions involving the tympanic membrane, ossicles, and middle ear mucosa. Tympanosclerosis increases the stiffness of the middle ear system.

volume velocity-the volume of air that passes through a plane per unit time.

References

Goodhill, V. (1979). Ear: Diseases, Deafness, and Dizziness. Harper and Row (Hagerstown, Md.).

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Margolis, R.H.; Heller, J. (1987). Screening tympanometry: criteria for medical referral. Audiology, in press.

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Terkildsen, K.; Thomsen, K.A. (1959). The influence of pressure variations on the impedance of the human eardrum. J. Laryngol. Otol. 73:409-418.

Van Camp, K.J.; Margolis, R.H.; Wilson, R.H.; Creten, W.; Shanks, J.E. (1988). Principles of Tympanometry. ASHA Monographs No. 24. American Speech-Language-Hearing Association (Rockville, Md.).

How Welch Allyn MicroTymp Works

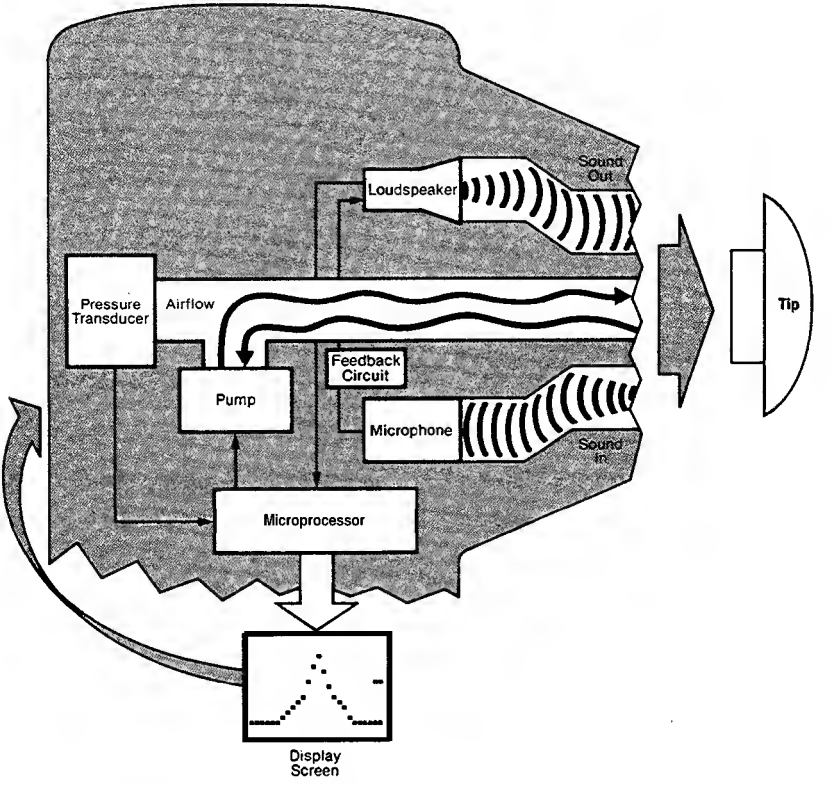
A block diagram of the Welch Allyn MicroTymp is shown below. A 226-Hz probe tone is introduced in the sealed ear canal by a miniature loudspeaker. A miniature microphone records and monitors the sound pressure produced in the ear canal.

The sound level is maintained at a constant 85 dB SPL throughout a test via the feedback circuit. Therefore, when the amount of sound absorbed by the middle ear increases, the speaker must be driven harder by increasing voltage to maintain the correct SPL.

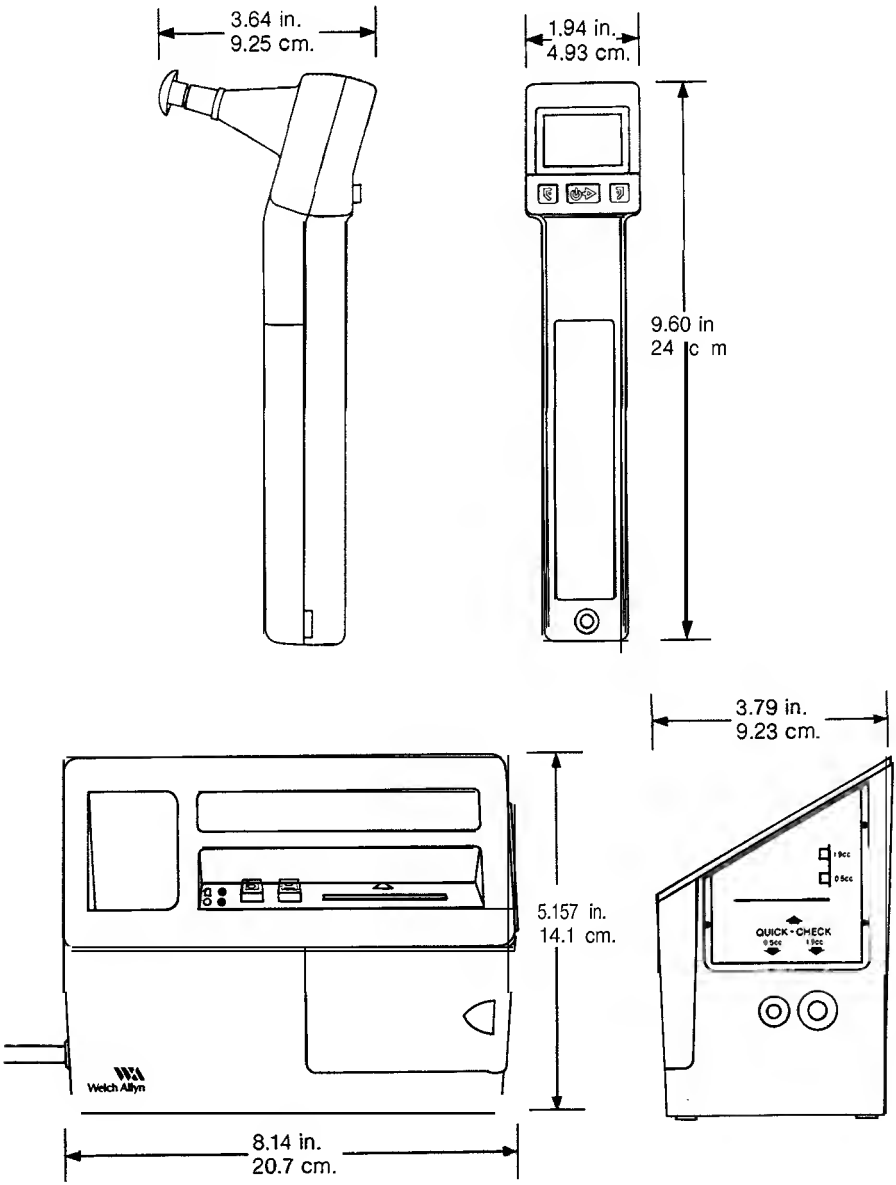
The voltage required to maintain the probe tone at 85 dB SPL is proportional to the acoustic admittance of the ear. As pressure in the ear canal is changed throughout a test, the microprocessor computes acoustic admittance and plots it out.

Pressure in the ear canal is changed with a miniature pump. The pressure transducer monitors pressure, feeding this information to the microprocessor so that it can control the pump.

For a more thorough discussion of design principles of acoustic immittance instruments, see VanCamp et.al., 1986, Chapter 4.



Technical Specifications



MicroTymp 0.64 lb./0.29 Kg.

Printer/Charger 2.9 lb./1.3 Kg.

Operating Temperature: 15° to 35°C (59° to 95°F). All specifications apply over this temperature range.

Storage Temperature: -20° to + 40°C (-4° to + 104°F).

Printer Paper: Thermal type, 58mm (2.28") wide x 19.8m (65') long with end-of-roll indicator, Welch Allyn No. 53600. Must be stored in dark, cool location, to prevent exposure of paper. 205 double-ear printouts per roll.

Battery: 7.2V nickel-cadmium rechargeable, Welch Allyn No. 72700, approximately 60 minutes continuous use. (See pg. 24)

Tips: Four color-coded sizes.

Probe Tone:

Frequency: 226 Hz ± 3%
Amplitude: 85 ± 3 dB re 20 uPa in an ANSI HA-1 (2cc) coupler.
Distortion: 5% maximum total harmonic distortion in an ANSI HA-1 (2cc) coupler.

Pump:

Direction of sweep: positive to negative pressure.
Speed: 200 ± 20 daPa/second average during data acquisition period

Pressure Measurement System:

Range: + **200** to **-300** daPa
Display resolution: 20 daPa
Accuracy: ± 15% or ± 10 daPa, whichever is greater.
Compensation: Auto-zero with each test cycle

Admittance Measurement System:

Range: 0.2 to 3.8 mmho total
0 to 1.5 mmho for Ya
0.2 to 2cc for + 200 Vea
Display resolution: .1 mmho for Ya
0.2cc for + 200 Vea
Accuracy: ± 0.1 mmho or ± 5%, whichever is greater.

Printer/Charger

Model Number	Input			Fuse		Plug Type	Recog-nition
	Nominal		Range V	Value (mA)	Type		
	V	A					
71130	120	.1	110-130	125	1	D	1,2
71132	230	.06	210-250	63	2	A	3,4
71133	100	.11	90-110	125	2	D	3
71134	230	.06	210-250	63	2	B	3,4
71136	230	.06	210-250	63	2	C	3,4

Input frequency for all models is 50-60 Hz. All units also include a 105°C automatically resetting thermal protective device in the secondary circuitry.

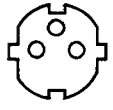
Fuse Types

1-3AG Slow Blow
2-5 x 20mm Time Delay

Recognition

1-UL Approved (UL 544) File No. E15508
2-CSA Certified (C22.2 No. 125) File No. LR16391
3-Compliant with IEC 601-1
4-Compliant with VDE 0871 B File No. T 4-1b B 3532
HfrG—Allg. Gen. 24.02.1988

Plug Types


A

B

C

D

Standards Compliance

This instrument complies with the following draft standards based on the most recent revision available at the time of design, and classification as a type 4 instrument:

American National Standard for Aural Acoustic-Immittance Instruments-83-60, Draft 1984A, 1 1/84.

IEC-Aural Impedance/Admittance Instruments Document 29C, Secretariat 46, 1/84.

Warning: NOT FOR USE IN THE PRESENCE OF FLAMMABLE ANESTHETICS. POSSIBLE EXPLOSION HAZARD.

DISASSEMBLY OF PRINTER/CHARGER PRESENTS POSSIBLE ELECTRICAL SHOCK HAZARD.

REFER ALL SERVICING TO QUALIFIED PERSONNEL TO PREVENT POSSIBLE FIRE HAZARD.

REPLACE BATTERY AND FUSES WITH SAME SIZE AND TYPE ONLY.

Welch Allyn gratefully acknowledges the assistance of Robert H. Margolis, Ph.D. of Syracuse University for his assistance in preparing the Introduction, Interpretation of Results, Criteria for Medical Referral, How the MicroTymp Works, and Glossary sections of this booklet.

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